User-Rating Based QoS Aware Approach for Selection of Updated Web Services to Web Service Composition

K.Vivekanandan[1] , S.Neelavathi, S.Subhashree, G.Kavitha, and S.Kavitha
Pondicherry Engineering College, India.
[1]Email: kvivek27@yahoo.com
Email: neelabaski@gmail.com, subhaa_shree@yahoo.co.in, kavi_gk08@yahoo.com, kavi_immac@yahoo.co.in

***Abstract*— The concept of dynamic composition of Web services has been given major importance in the recent years. While there are many systems available to select the services with the highest QoS score, very little thought has been given to the fact of constructing a model which takes in the user's rating of a service as a major input for selection. A robust system for fetching the most updated version of the selected services and selection of the services based on users' ratings of the QoS values rather than on the actual QoS values has been presented in our paper.**

***Index Terms*— Web Service selection, rating, updated services, aging factor**

I. Introduction

Web service composition comprises two steps, namely, composition schema planning and optimized service selection [3]. When many services offer similar functionality QoS values play a critical role in isolating the optimal service for that particular task. Our main focus is upon improvising the technique for service selection by means of an advanced approach based on the user ratings rendering provisions to maximize the service quality ratings given by the user in order to satisfy his expectation measures [5]. Emphasis is also given to check the age of the selected service paving way to replacement of old versions of services by their updated versions [4]. The ability to gauge quality of service is critical if we are to realize the potential of the service-oriented computing paradigm. It is essential, therefore, that a service selection system should choose a service that meets not only the required capability with the highest QoS score, but also that would increase the user's quality rating. Various methods for modelling, calculating and monitoring QoS ratings have been proposed in the literature. A common approach is to collect quality ratings from the users of a service and then aggregate them in some way to derive the quality of the service [5]. This strategy has been incorporated into the dynamic composition model in this paper.

II. RELATED WORKS

D.M.Liu brought out two web service selection methods for elementary and complex services respectively, which are driven by user's QoS expectation. But as this algorithm's computation cost is high, it was not applicable to solve large scale problems [1]. Y. Yang designed a QoS-based service selection mathematical model and corresponding heuristic algorithm for service composition. The multiple dimensional resources are merged into a whole, using a transformer vector but the process of leveraging transformer vector is complicated [2]. D.M.Liu came out with a new approach i.e Multiple Criteria Decision Making technique to solve multiple resource constraints problem for Web service composition [3]. Farhan Hassan Khan et al proposed a technique by combination of interface based and functionality based rules. The proposed framework also solved the issues related to unavailability of updated information in web services [4]. V.Deora proposed a quality of service assessment model that enables the capture of the normalized ratings given by different users [5]. Eyhab Al-Masri introduced the Web Service Relevancy Function (WsRF) used for measuring the relevancy ranking of a particular Web service based on QoS metrics and client preferences [6]. Murat Sensoy proposed that consumers objectively record their experiences, using ontology to capture subtle detail which can then be interpreted by consumers according to their own criteria and contexts. [7]. Paul G. Sorenson has put forward a technique that compares functionally equivalent services on the basis of the customers' perception of the QoS attributes rather than the actual attribute values. He utilizes the 'mid-level splitting' method to track the customer's preference vis-a-vis the actual attribute values. But he does not consider the resource constraint satisfaction aspect [8].

III. Architecture

The following figure shows the architecture of our proposed system which would work in the environment of a dynamic composition query taking in the composite query as input and outputting the service with optimal satisfaction rating of the user as the final result. The user interface takes in the complex query given by the client.

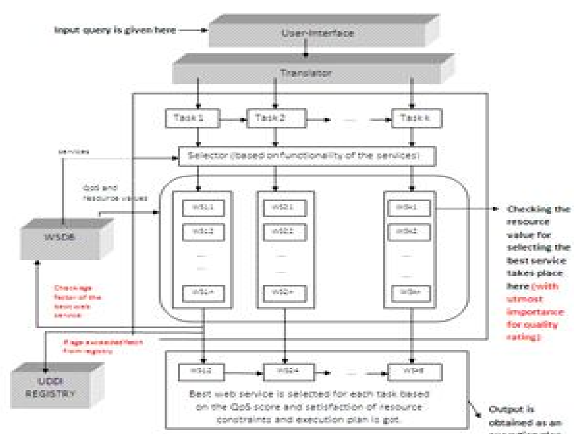

Figure 1. Architecture of the proposed system

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IV. METHODOLOGY

Given below are the algorithms used for the proposed system. Once the complex query is given by the user, it is analyzed and the individual tasks are distinguished. Based upon the query, the category of selection is identified. After classifying the category of the selection, for each task the given process is to be applied. If there are no constraints on the resource consumption specified by the user, then it falls under the first category. If not, then it is to be checked whether the specified resource consumption constraints are along single or multiple dimensions.

```
Algorithm to select services based on quality rating:
if(category=1) then
{
 Obtain the QoS parameter for which the user's expectation rate is high.
 Calculate the aggregate ratings of all previous users for each service with respect to the inputted QoS parameter.
 Return the service with maximum aggregate rating
}
else
{
Apply convex hull algorithm to minimize the number of candidate services.
Check which services satisfy the resource constraints given by the user.
  if(category=2) then
          constraint should be applied directly
  else
    merge the resource constraints into a single dimensional one
Obtain the QoS parameter for which the user's expectation rate is high.
Calculate the aggregate ratings of all previous users with respect to the inputted QoS parameter for each service which satisfies the resource constraint.
Return the service with maximum aggregate rating
```

For every category, before outputting the complete solution X, the following algorithm will be applied to each task's chosen best service. If the aging factor value of the selected service for that task is beyond a threshold value then it means the service is of an older version and hence the updated version of the same is fetched from the UDDI registry and given as output. After performing this 'k' number of times (where k is the total number of tasks), the final solution X consisting of the updated best services for all the tasks will be outputted as the ultimate result.

```
Algorithm to check the aging factor and update the service:
      For i=1 to k do{
            Read the aging factor(af) of x_i from the WSDB
            If af(x_i)=0 then{
                  Replace the current version with the updated version from the UDDI registry;
                  Update the af(x_i) with the new aging factor; }}
```

V. EVALUATION

Using a fitness formula similar to that of WSRF proposed in [6], the proposed system has been evaluated. The fitness formula used for estimating the value of a web service is given as follows: Each QoS measured value is compared against the maximum in its corresponding set based on the following Equations:

$$h_{i,j} = w_j \left(\frac{q_{i,j}}{\max(q_{i,j})} \right) \qquad (1)$$

where $q_{i,j}$ represents QoS measured value of a particular ws_i and QoS parameter and $h_{i,j}$ measures the distance of $q_{i,j}$ from the maximum normalized value in the corresponding QoS property group or j column, and w_j represents the weight associated with a QoS parameter. The final fitness formula is denoted as:

$$\sum_{j=1}^{m} h_{i,j} + w_r R \qquad (2)$$

where m is the total number of QoS parameters considered, w_r is the weight for the rating given by the user, R is the rating value for the service.

VI. RESULTS AND DISCUSSIONS

Taking three hundred candidate services for each task for our experimentation, the conventional approach of selecting services based on QoS values and the proposed approach of user-rating based service selection have been implemented. Five QoS parameters, namely, Price, Availability, Response time, Reputation and Successful completion have been considered for our implementation and our implementation environment is that of JAVA with Microsoft Access as the backend. Based upon the fitness formula given above, the implemented systems have been evaluated and the results obtained are given below:

A. Case 2: (With single dimensional constraints)

The existing work and proposed work have been executed with a set of resource constraints along a single dimension and the following output has been generated:

TABLE I.
SET OF USER RATING AND FITNESS VALUES FOR CASE 2 UNDER EXISTING WORK

USER RATING VALUE OF PRICE (X AXIS)	FITNESS VALUE(Y AXIS)	CONSTRAINTS
0.36	0.457	RESP. <=1000
0.4	0.718	PRICE<= 28
0.46	0.595	PRICE <=100
0.55	0.479	PRICE<= 200

TABLE II.
SET OF USER RATING AND FITNESS VALUES FOR CASE 2 UNDER PROPOSED WORK

USER RATING VALUE OF PRICE (X AXIS)	FITNESS VALUE(Y AXIS)	CONSTRAINTS
0.64	0.866	PRICE<=100
0.67	0.924	PRICE<= 28
0.74	0.849	RESP. <=1000
0.78	0.866	PRICE <= 200

Taking rating value along x axis and fitness value along y axis, the following graph has been obtained with various resource constraints along single dimension. It can be seen that for the same resource constraint, the fitness value of service obtained through existing work is lower compared to that of the service obtained through proposed work. For

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example, considering the resource constraint of price <= 28, the fitness value of the service obtained through existing work is 0.718 whereas the fitness value of that obtained from proposed work is 0.924. The lesser value of the former fitness value can be attributed to the fact that as rating value increases, the fitness value soars high.

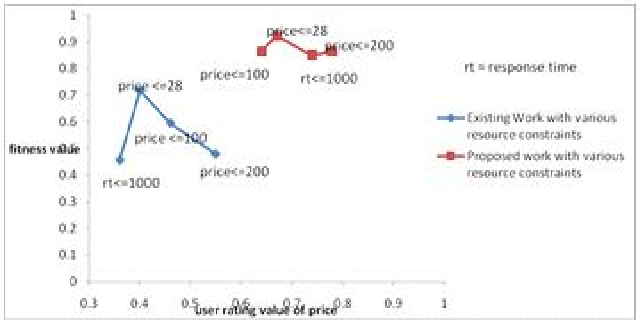

Figure 2. Results obtained from case 2 with varying single dimensional resource constraints

A. Case 3: (With multiple dimensional constraints)

Similar to that of case 2, taking rating value along x axis and fitness value along y axis, the following graph has been plotted with various resource constraints along multiple dimensions. It can be seen that for the same set of resource constraints, the fitness value of service obtained through existing work is lower compared to that of the service obtained through proposed work.

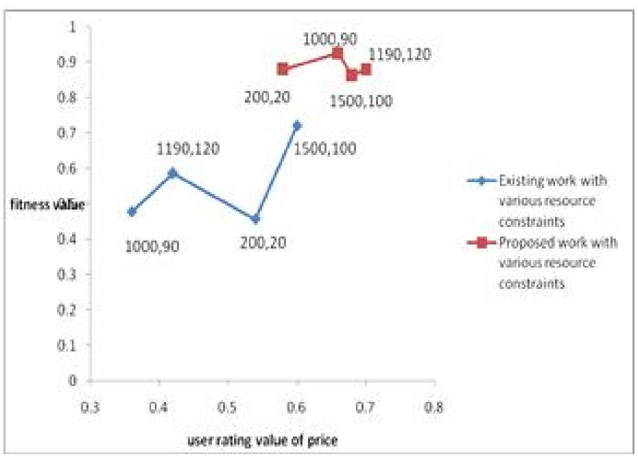

Figure 3. Results obtained from case 3 with varying multiple dimensional resource constraints

Conclusions

Emphasis on utilizing metrics to obtain most recent version of services and a more satisfactory and reliable means for service selection based on users' quality ratings for services is a mandatory need of the current day. This has been highlighted in our work paving way to a novel method to satisfy the user's requirements thus increasing the fitness value of the selected service.

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